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ABSTRACT

The purpose of this practicum was to develop and implement a remedial mathematics program to improve the basic mathematics skills of seventh-grade students at Nathan B. Young Junior High School who fail to master the required minimal objectives on the seventh-grade "Criterion Referenced Test" (CRT). Target students were screened for their mathematical ability on the "Comprehensive Test of Basic Skills" (CTBS). Based on the test results, students were assigned to the Compensatory Education classes for daily instruction in mathematics. Their mathematical weaknesses were diagnosed and individualized prescriptions were instituted for each student in the program. Compensatory Education mathematics teachers attended inservice meetings that provided professional training in the implementation of the Intuitive Math strategy. After the treatment period, the CTBS and the CRT were administered to the target population. The posttests revealed that the behavioral objectives were successful. Therefore, it is concluded that the Intuitive Math strategy integrated with the Individualized Approach is beneficial to students with basic mathematical problems. As a result of conducting this practicum, this program has been adopted by five additional seventh-grade centers within the Hillsborough County School District. (Author)

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A REMEDIAL MATH PROGRAM IN A SECONDARY SCHOOL

by

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Submitted in partial fulfillment of the requirements
for the degree of Doctor of Education
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Solo Group Practicum Report
Tampa Cluster
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A REMEDIAL MATH PROGRAM IN A SECONDARY SCHOOL

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Abstract

The purpose of this practicum was to develop and implement a remedial mathematics program to improve the basic mathematics skills of seventh grade students at Nathan B. Young Junior High School who fail to master the required minimal objectives on the seventh grade Criterion Referenced Test (CRT).

In the remedial mathematics program, there were six basic components: Screening, Diagnosing, Prescribing, Teacher Inservice Training, Program Implementation and Evaluation. Target students were screened for their mathematical ability on the Comprehensive Test of Basic Skills (CTBS). Based on the test results, students were assigned to the Compensatory Education classes for daily instruction in mathematics. Their mathematical weaknesses were diagnosed and individualized prescriptions were instituted for each student in the program. Compensatory Education mathematics teachers attended inservice meetings that provided professional

training in the implementation of the Intuitive Math strategy. After the treatment period, the Comprehensive Test of Basic Skills and the Criterion Referenced Test were administered to the target population. The posttests revealed that the behavioral objectives were successful. Therefore, it is concluded that the Intuitive Math strategy integrated with the Individualized Approach is beneficial to students with basic mathematical problems. As a result of conducting this practicum, this program has been adopted by five additional seventh grade centers within the Hillsborough County School District.

CHAPTER I

INTRODUCTION

General Statement of the Problem

The development of mathematics skills is a central task and focus of the school's curriculum. The skills in this area are most needed by the student for they provide the basis for success both in the later school years and after school completion. Despite their crucial importance to the future chances of each individual student, there are significant numbers of students at the secondary level who lack these necessary mathematics competencies.

In the Hillsborough County School System, compensatory education funds are provided to assist students who fail to master the minimum basic skills in mathematics. Nathan B. Young Junior High School has a Compensatory Education Program which has been in effect for two years. The Criterion Referenced Test (CRT) was developed for the Compensatory Education Program.

However, at Nathan B. Young Junior High School, for the past two years 20 percent of students were identified as not achieving the stated objectives. In order to achieve the stated objectives, it was essential that the treatment be improved.

Description of the School and the
Community

The Hillsborough County School System is located on the West Coast of Florida with the metropolitan area of Tampa being the hub. The 1980 census reflects a population of approximately 635,000 persons.¹ The District is probably Florida's most diverse. The diversity expresses itself in its various natural resources, economic disparities and the degree and extent of educational attainment. The District, with over 115,000 pupils, K-12, housed in 132 elementary and secondary schools, is the fourth largest in the State of Florida and the twenty-second largest school system in the nation.

Nathan B. Young Junior High School is one of twenty-six junior high schools in the Hillsborough County School System. It is an attractive school located in a lower socio-economic neighborhood. The writer has served as principal of the school for two years. The faculty consists of fifty-eight members which include: seven math teachers, seven science teachers, seven English teachers, seven social studies teachers, two guidance counselors, two librarians, two music teachers, six physical education teachers, one agriculture teacher, one health teacher, one teacher for the emotionally handicapped, two specific learning disabilities teachers, one shop teacher,

¹Hillsborough County Planning Commission, Population and Housing Estimates, April 1, 1975 - January 1, 1980, p. 22.

one business teacher, one typing teacher, one art teacher, two teachers for the Educable Mentally Handicapped, an itinerant speech teacher, two dean of students, one resource officer, two reading teachers, and one principal. All teachers are fully certified by the State Department of Education in their subject areas.

Nathan B. Young Junior High School is based on seven blocks of seven sections in each block with a total enrollment of 1,150 students, 80 percent white and 20 percent black. Each block has approximately 150 students with seven instructional sections of not more than thirty students with one English teacher, one mathematics teacher, one science teacher, one social studies teacher, and one elective teacher assigned. The teachers in each group have the flexibility to group students with specific guidelines and to team teach (interdisciplinary and/or disciplinary) and use other innovative practices.

Eighty-five percent of the students attending Nathan B. Young Junior High School are transported from communities within a radius of twenty-three miles. These communities are highly diversified with educational statuses ranging from elementary grades to post graduate.

Academically, Nathan B. Young ranks above the national norms on the Comprehensive Test of Basic Skills and the Short Form Test of Academic Aptitude given annually to all students.

The school has a good reputation within the county and has received recognition for its many outstanding educational programs.

CHAPTER II

NEEDS ASSESSMENT

The Educational Accountability Act of 1976, Sections 229.565 and 229.57, Florida Statutes established a statewide minimum student performance standards for grades 3, 5, 8, and 11.² As a result of this legislation, the Minimum Student Performance Standards for Florida Schools was adopted in April 1977. The minimum student standards adopted were based on the minimal objectives which were developed cooperatively by the Florida Department of Education, universities in the state, and local school systems. These minimum standards addressed the basic skills in reading, writing, and mathematics. Based on the minimum student performance standards, the Statewide Student Assessment Test I and II (SSAT I & II) was developed. The SSAT-I measures basic skills and is administered in grades 3, 5, and 8. The SSAT-II is designed as a functional literacy test and is administered in the eleventh grade.

According to the Educational Accountability Act of 1976, if a student fails to master one or more of the minimum performance standards on which he is tested, the school system

²Tallahassee, Florida, "Educational Accountability Law," Laws of Florida, Vol. I, General Acts (1976), sec. 229.565.

shall provide special instructional assistance for each such student in a manner deemed appropriate by policies of the district school board.³

In the Hillsborough County Public Schools, if a student performs poorly on the SSAT, compensatory education funds are established to assist in the educational remediation process. Due to the impact of this Educational Accountability Act of 1976, the staff of the Hillsborough County Public Schools felt that a "pre-assessment" test was necessary for early identification and remediation of students who might perform poorly on the SSAT with the intention of predicting which students would do poorly when the SSAT I was administered. Furthermore, the staff felt that a "pre-assessment" test was necessary in order to produce a map or profile of the students.

In developing a "pre-assessment" test, Minimum Performance Standards in the eighth grade were designed to be entry level skills for the eighth grade or exit skills for the seventh grade. The result of the development of a seventh grade Criterion Referenced Test (CRT) in mathematics based on the basic skills and standards tested on the eighth grade SSAT-I, 1977-1978.

Since item specifications were not available for the SSAT-I, the Hillsborough County School System contracted the

³Tallahassee, Florida, "Educational Accountability Law," Laws of Florida, Vol. I, General Acts (1976), sec. 229.57.

department of testing and evaluation of the University of South Florida for this purpose. The first task in the developmental procedure was to examine the State items, skills, standards in order to build item specifications for each skill. Next, committees of seventh grade teachers and subject area supervisors were formed to critique the item specifications and to write items. A pilot test of the items was then given to a small sample of students to assess the following: (a) item bias (race and sex); (b) item clarity; (c) readability; and (d) item content matched with skills.

After the pilot was administered, items were reviewed and rewritten so that they conformed to the above criteria. Following the item revision, a final test was constructed for all students to be taken in the fall and a match was made of the skills measured on the Hillsborough County CRT and the SSAT-I. The purpose of the fall test was to determine if the students who succeeded or failed on the SSAT-I was consistent with scores on the CRT. According to the department of testing and evaluation of the Hillsborough County Public Schools, the major problem with the fall test was the time interval between SSAT-I administration and the CRT administration. However, a trend did develop. Students who performed poorly in certain areas of the SSAT-I continued to perform poorly in the same areas of the CRT. Through the pilot test, reviews, and the fall test, validity of content was established, i.e., the test measured what it is designed to measure.

Reliability was not established due to the nature of the test. Since Hillsborough County's CRT and the Statewide Student Assessment Test--Part I are both criterion-reference tests and both were designed so that most students would pass them, it is statistically impossible to develop a reliability coefficient. This is due mainly to the restricted variance of the test (i.e., many students should score very high).

Through inspection of subsequent administrations of the CRT, the Hillsborough County CRT will predict failure on the SSAT-I. In the seventh grade, the CRT is administered in order to determine which skills the student needs to be taught. However, before the CRT is applied in September of the seventh grade, the Comprehensive Test of Basic Skills is administered to students in the spring of the sixth grade. The CTBS is utilized as a screening device in order to determine which students are to be placed in the Comprehensive Education Program in the seventh grade. The CTBS is administered each year in the sixth and seventh grades in Hillsborough County. It measures content in the areas of reading (comprehension and vocabulary), language, mathematics, and study skills.

In the seventh grade, the CRT is administered in September as a pretest and in March as a posttest. Even though there has been a substantial improvement on the scores of the CRT, for the past two years, 20 percent of the

Compensatory Education students at Young Junior High have failed to master the required skills.

For this practicum, the remedial math students were identified according to the CTBS administered in the sixth grade in the spring of 1980. Those students who were assigned to the Compensatory Education Math Remediation Program in the seventh grade obtained a raw score below 51 or the 25th percentile in math on the Spring CTBS. This criterion has been used in previous years (see Appendix 1).

The practicum presented is an implementation of a plan to remediate all Compensatory Education Math students who entered Young Junior High in the fall of 1980 and who met the criteria. Based on this criteria, seventy-five students were identified for the Compensatory Education Program.

CHAPTER III

OBJECTIVES

Based on the Criterion Referenced Test results, 20 percent of the Compensatory Education Math students at Nathan B. Young Junior High School were not mastering the required skills. Therefore, the following program objectives were developed.

1. Upon completion of the remediation process, utilizing the Intuitive Math Program in conjunction with the Individualized Prescriptive Approach, 50 percent of the target students will achieve a raw score of 63 or more on the spring (1981) administration of the seventh grade mathematics Criterion Referenced Test to be exempt from the 1981-82 Compensatory Education Program.
2. Upon completion of the remediation process, utilizing the Intuitive Math Program in conjunction with the Individualized Prescriptive Approach, the individual target population will increase their test scores by the equivalent of one month per month of instruction

when administered the CTBS Mathematics Section in a pre-posttest design with the pretest in March 1980, and the posttest in March 1981.

CHAPTER IV

PROGRAM STRATEGY

Research to Develop Strategy

Many solutions are being attempted in secondary schools since teachers and administrators have become concerned about the math difficulties of the pupils. The solution will vary with each county and within each school. This practicum attempts to develop and implement an instructional strategy that will provide an effective remedial math program to help improve the basic math skills of all Compensatory Education students at Nathan B. Young Junior High School. These students require individual assistance and reinforcement.

The research conducted by Virginia Shipman and the Educational Testing Service reveals that teaching students just basic skills is not enough.⁴ According to Shipman, students need to be taught the basic skill of critical thinking. The researcher further states that the theory works not as a substitute for the 3 R's but as a booster shot. The researcher concludes that children's minds can literally be stretched, and when that happens improvement in the basic skills will follow.

⁴Virginia Shipman, "About Education: A Booster Shot to the Three R's," The New York Times, February 27, 1979, C 5-6.

June Gabler, school superintendent in Woodhaven, Michigan, has introduced a junior high school course in critical thinking that branches out from mathematics into reading and the interpretation of facts.⁵ The purpose of the course is to teach students to think critically and logically. According to the researcher, students who have taken the course scored significantly higher on achievement tests in all subjects.

Research by Enrenberg and the ASCD reveals that critical thinking is in big trouble in the American classroom.⁶ Study after study indicates that students fail to translate what they know into systematic ways of viewing and coping with practical problems. According to the researchers from ASCD, students must learn to apply what they've learned; otherwise, millions of students may find themselves unprepared for the increasingly complex and technological future that lies ahead.

The latest disturbing findings come from the National Assessment of Educational Progress (NAEP) in mathematics.⁷ Sampling 71,000 children, Enrenberg and others found that from 1973 to 1978, 17-year-olds showed measurable drops in each of the cognitive process levels assessed. At each age, fewer students appeared proficient in solving problems deemed

⁵Ibid.

⁶Sydelle Enrenberg, "Basics Movement is Hindering Problem-Solving Skills: Thinking Can Be Taught," ASCD: News Exchange 22 (February 1980), p. 2.

⁷Ibid., p. 5.

appropriate for their age level. For example, nine-year-olds' performance dropped considerably on one-step word problems. Generally, fewer 13- and 17-year-olds could solve multi-step, complex problems or could deal with such topics as percent, probability and statistics.

From the Institute for Curriculum and Instruction in Miami, Florida, Ehrenberg's study indicates that too much modern teaching focuses on how to gather and process information, while ignoring the necessary step of applying it to specific goals.⁸ The researcher contends that this is why children cannot do problem-solving. Ehrenberg further states that children lack the foundation for problem-solving. The application of knowledge and skill from previous experiences is necessary in order to achieve problem-solving.

Whimbley's studies indicate that classroom emphasis on speed and mental calculation frustrate natural abilities, particularly among slower learners.⁹ The researcher advocates a greater stress on careful sequential logic instead of time and speed used by the student.

According to Benjamin Bloom and Lois Broder, a major cause for low aptitude students failing to solve problems effectively is that they are unskilled in breaking a problem

⁸Ibid., p. 11.

⁹Arthur Whimbley, "Teaching Sequential Thought: The Cognitive-Skills Approach," Phi Delta Kappan 26 (December 1977), p. 1.

into clear sequential steps.¹⁰ The researchers further state that low aptitude students are not skilled in organized, sequential attacks on information.

Using Rubenstein's Patterns of Problem Solving, Steve Bartlett developed a program combining vocalized practice in philosophical reasoning.¹¹ As a result of the program, students gained an average of six IQ points on the Comprehensive Test of Mental Maturity. Bartlett's study further reveals that the effective vocalized problem solving teaches the students to independently develop careful analysis with respect to a set of related problems.

In the Gilrod study, the THINK program was developed.¹² The goal of the program is to train the student's brain to function independently of what is going into it. Because the program is not content-oriented, the researcher contends that THINK can be applied to any subject area without overhauling curriculum. Gilrod concludes that approaches such as THINK supplement existing formats rather than replace them.

¹⁰ Benjamin S. Bloom and Lois J. Broder, Problem-Solving Process of College Students (Chicago: University of Chicago Press, 1960).

¹¹ Steven Bartlett, "The Use of Protocol Analysis in Philosophy," in Metaphilosophy (in press).

¹² Mike C. Gilrod, "Basic Movements Is Hindering Problem-Solving Skills: Thinking Can Be Taught," ASCD News Exchange 22 (February 1980), p. 6.

According to Jensen's study, comprehensive education has been tried and has failed.¹³ The researcher contends that the reason for this failure is that comprehensive education programs have been too isolated. Jensen recommends that comprehensive education programs become fullpledged cognitive education.

Rationale for Strategies Used

From the review of the literature, it was concluded that critical thinking strategies must be applied in remedial programs. Furthermore, these critical strategies are not designed to replace existing programs. Instead, these strategies are designed to supplement and enable students to become more efficient in the problem-solving process.

Because problem solving is a basic skill that is tested on the Criterion Referenced Test, the Intuitive Math Program was integrated into the diagnostic/prescriptive approach of instruction. The Intuitive Math Program introduced the student to logic and comprehension (see Appendix 2). According to the developers of the program, logic and comprehension will increase the student's ability to improve the use of his mind. This is accomplished by teaching the student to turn environmental data into useful information, to solve problems, and to improve his thinking process. Therefore, this program will enable students to become better decision makers.

¹³ Arthur Jensen, "How Much Can We Boost I.Q. and Scholastic Achievement?" Harvard Educational Review 39 (Winter 1969), pp. 1-3.

CHAPTER V

PROGRAM IMPLEMENTATION

Being that 20 percent of the Compensatory Education math students at Nathan B. Young Junior High were not mastering the required minimal objectives, it was essential that the Compensatory Education Program be modified. This was accomplished by integrating the existing strategy, the individualized prescriptive approach, with the Intuitive Math Program. Students' remedial instruction was directed toward the required objectives based on the individual student's test information utilizing the diagnostic/prescriptive approach and the Intuitive Math Program.

Identification of Target Students

A total of seventy-five students were selected for the program. Those students who scored below 51 or the twenty-fifth percentile in total math on the Spring Comprehensive Test of Basic Skills (CTBS) were selected to participate in the program.

Program Operation

In order to implement the diagnostic/prescriptive approach to individualized instruction and the implementation

of the Intuitive Math Program, five classes of Compensatory Education students were assigned to a math class conducted by a Compensatory Education math teacher at a ratio of 15 to 1. A total of seventy-five students comprised the target group. These students attended the Compensatory Education class for fifty-five minutes each day, five days per week.

In September, each target student was administered a locally developed Criterion Referenced Test in mathematics to determine his specific weakness in mathematics. From the Criterion Referenced Test, diagnostic maps were developed. The Compensatory Education mathematics teacher implemented the diagnostic/prescriptive approach for each target student utilizing the individual student's diagnostic map. Therefore, the instructional strategy was related to each student's individual needs.

The remedial instruction was directed towards the skills tested on the Criterion Referenced Test. Each of these skills were considered the instructional objectives for each student. Consequently, the instructional strategy was related to the criterion referenced skills. Also, the remediation program fulfilled state and county requirements, therefore, meeting the needs of the individual students.

A major component of the remedial program was to teach problem-solving techniques. The problem-solving skills were emphasized throughout the remediation program in order for each student to learn techniques in answering test questions. Being

that there is such as emphasis on the test for the purpose of assessing the student's abilities in applying basic skills to practical problems, test-taking techniques were taught to ensure that poor test-taking skills would not affect the student's performance on the test.

Three full-day orientation inservice sessions were conducted by the Intuitive Math Program consultant to assist Compensatory Education teachers in implementing the Intuitive Math modules.

The objective of the three-day inservice sessions was to present a program aimed at improving the basic math skills of all Compensatory Education students at Nathan B. Young Junior High School. The topics incorporated in the inservice program designed to meet the objectives were as follows.

Teacher Inservice Operations

- A. The Name of the System
- B. Consultant's Name/Company's Name
- C. How To Get in Touch With the Main Office
- D. How To Get in Touch With the Consultant
- E. The Progression of "Learning Technologies"
 - 1. First--Lecture/Test
 - 2. Second--Programmed Instruction
 - 3. Third--THINK
- F. How Intuitive Math is Designed
 - 1. Modules
 - 2. Levels

- G. How the Modules are Designed
 - 1. Workbooks
 - 2. Content
- H. How the Workbooks are Designed
- I. How the Learning Sequences are Designed
- J. How the Moderator's Guide Correlates
 - 1. Teacher objectives/key training concept
 - 2. Teaching sequence
- K. Math Skills Practice Sheets
- L. How the Mini-Quizzes Correlate
- M. What the THINKING Skills are, and how each one works
- N. How the Logic and Comprehension Exercises are Designed
- O. How Reflex Math is Designed
- P. How the Reflex Math Tapes are Designed
- Q. How the Student Progress Record is Designed
- R. What Purpose is Served by the Intuitive Math Objectives Checklist
- S. How the Placement Test Package is Designed
- T. Management
- U. Student Orientation
 - 1. Introducing THINKING Skills Kit
- V. Personal Concerns

A workshop evaluation instrument was used to measure the effectiveness of the inservice sessions (see Appendix 3).

CHAPTER VI

EVALUATION

Product Evaluation

The first objective of the program was as follows:

Upon completion of the remediation process, utilizing the Intuitive Math Program in conjunction with the Individualized/Prescriptive Approach, 50 percent of the target students will achieve a raw score of 63 or more on the March 1981 administration of the seventh grade mathematics Criterion Referenced Test to be exempt from the 1981-82 Compensatory Education Program.

The Criterion Referenced Test results are presented in Table 1. Ten students failed to meet the objective while sixty-five met or exceeded the objective.

Evaluation Summary

Of the total seventy-five students, 87 percent met or exceeded the objective. The mean raw score for the group was forty-two before participation in the program. At the conclusion of the program, the mean raw score was sixty-nine, an

Table 1

Criterion Referenced Pre- and Posttest Data

Student	<u>Pretest</u> Raw Score	<u>Posttest</u> Raw Score	Gain
1	35	64	29
2	39	65	26
3	54	93	39
4	36	76	40
5	52	80	28
6	39	67	28
7	33	93	60
8	43	70	27
9	58	83	25
10	45	71	26
11	37	73	36
12	22	58 *	36
13	47	73	26
14	37	73	36
15	36	71	35
16	49	66	17
17	53	83	30
18	30	78	40
19	57	75	18
20	36	43 *	7
21	41	72	31
22	42	81	39
23	12	49 *	37
24	11	53 *	42
25	52	71	19
26	49	64	15
27	27	70	43

* Did not meet criteria

Table 1 (Continued)

Student	<u>Pretest</u> Raw Score	<u>Posttest</u> Raw Score	Gain
28	37	74	37
29	39	73	34
30	24	79	55
31	30	95	65
32	30	64	34
33	38	78	40
34	37	49 *	12
35	44	64	20
36	52	91	39
37	28	83	55
38	33	40 *	7
39	34	63	29
40	34	35 *	1
41	45	65	20
42	75	90	15
43	51	83	32
44	49	73	24
45	38	64	26
46	48	82	34
47	52	68	16
48	61	96	35
49	42	75	33
50	43	70	27
51	33	53 *	20
52	36	42 *	6
53	39	60 *	21
54	51	83	32
55	60	67	7
56	57	69	12
57	54	86	32
58	61	84	23

Table 1 (Continued)

Student	<u>Pretest</u> Raw Score	<u>Posttest</u> Raw Score	Gain
59	48	68	20
60	33	92	59
61	41	68	27
62	49	64	15
63	58	78	20
64	43	63	20
65	41	71	30
66	39	67	28
67	52	75	23
68	49	65	16
69	51	84	33
70	38	64	26
71	44	66	22
72	39	62	23
73	42	64	22
74	41	67	26
75	51	74	23
N = 75	Mean 42	69	28

increase of twenty-seven. The greatest amount of gain was a raw score of ninety-six and the least amount of gain was thirty-five.

The objective was successful since 87 percent achieved a raw score high enough to be exempt from the Compensatory Education Program in 1981-82.

The second objective of the program was as follows:

Upon completion of the remediation process, utilizing the Intuitive Math Program in conjunction with the Individualized/Prescriptive Approach, the individual target population will increase their test scores by the equivalent of one month per month of instruction when administered the Comprehensive Test of Basic Skills Mathematics Section in a pre-posttest design with the pretest in March 1980, and the posttest in March 1981.

The actual test results are presented in Table 2. Of the seventy-five students in the group, three failed to meet the objective. The mean grade equivalent before participation in the program was 4.1 and the mean deficiency was 2.5. After participation in the program, the mean grade equivalent was 5.8, an increase of 1.7. The greatest amount of gain was thirty-six months and the least amount of gain was five months.

Table 2

Target Population Data with Actual Months Gained

Student	Pretest			Posttest	
	Grade Equivalent	Academic Aptitude Stanines	Deficiency	Grade Equivalent	Actual Months Gained
1	4.7	4	2.0	5.9	14
2	2.6	1	4.1	3.8	14
3	4.7	4	2.0	5.6	11
4	2.9	1	3.8	4.0	13
5	4.6	3	2.1	6.0	16
6	3.5	2	3.2	4.9	16
7	2.8	1	3.9	3.8	12
8	4.5	3	2.2	6.1	19
9	4.2	3	2.5	6.0	20
10	4.6	3	2.1	6.2	18
11	4.6	3	2.1	6.4	20
12	4.6	3	2.1	5.8	14
13	4.5	3	2.2	6.0	17
14	4.6	3	2.1	6.0	16
15	4.7	4	2.0	5.2	5 *
16	4.7	3	2.0	5.9	14
17	4.6	3	2.1	6.9	27
18	4.7	4	2.0	6.4	19
19	3.5	2	3.2	5.0	17
20	4.2	3	2.5	6.0	20
21	4.7	3	2.0	5.2	5 *
22	4.7	4	2.0	5.8	13
23	4.6	3	2.1	6.1	17
24	4.6	3	2.1	6.2	18
25	3.5	2	3.2	5.7	26

* Did not meet criteria

Table 2 (Continued)

Student	Pretest			Posttest	
	Grade Equivalent	Academic Aptitude Stanines	Deficiency	Grade Equivalent	Actual Months Gained
26	4.6	3	2.1	6.3	19
27	4.6	3	2.1	6.2	18
28	4.7	4	2.0	7.2	29
29	4.7	3	2.0	6.3	18
30	4.6	3	2.1	6.7	25
31	3.6	3	3.1	6.2	30
32	3.5	2	3.2	5.7	26
33	3.6	2	3.1	5.8	26
34	4.7	4	2.0	5.9	14
35	3.6	2	3.1	5.4	20
36	4.6	3	2.1	6.8	26
37	2.8	1	3.9	4.4	18
38	4.7	4	2.0	6.4	19
39	3.3	2	3.4	5.9	29
40	4.2	1	3.8	5.1	26
41	2.9	1	3.8	5.1	26
42	2.8	1	3.9	5.2	28
43	2.9	1	3.8	5.0	25
44	3.5	2	3.2	6.4	31
45	3.2	2	3.5	6.2	36
46	4.7	4	2.0	6.4	19
47	4.6	3	2.1	5.6	12
48	3.6	2	3.1	4.1	5 *
49	4.7	4	2.0	6.3	18
50	3.6	2	3.1	5.0	16
51	4.5	3	2.2	5.2	7
52	4.7	4	2.0	5.7	12
53	4.6	3	2.1	5.4	8

Table 2 (Continued)

Student	Pretest			Posttest	
	Grade Equivalent	Academic Aptitude Stanines	Deficiency	Grade Equivalent	Actual Months Gained
54	4.7	4	2.0	5.4	7
55	3.6	2	3.1	4.7	13
56	4.7	3	2.0	5.4	7
57	3.5	2	3.2	4.5	12
58	4.7	4	2.0	5.4	7
59	4.6	3	2.1	5.6	12
60	4.7	4	2.0	6.0	15
61	4.7	4	2.0	5.8	13
62	4.7	4	2.0	6.1	16
63	4.7	4	2.0	5.7	12
64	4.2	3	2.5	5.2	12
65	2.9	1	3.8	4.0	13
66	3.6	2	3.1	5.1	17
67	4.6	3	2.1	5.7	13
68	4.7	4	2.0	5.4	7
69	4.6	3	2.1	5.5	9
70	4.6	3	2.1	5.7	13
71	4.5	3	2.2	5.7	14
72	4.6	3	2.1	5.5	9
73	4.4	3	2.3	5.4	12
74	4.7	4	2.0	5.5	8
75	4.2	3	2.5	6.0	20
N=75	Mean 4.1		2.5	5.8	16

The objective was successful since 96 percent of the students increased their scores one month per month of instruction and more.

CHAPTER VII

INSTITUTIONALIZING THE PRODUCT

In the Original Setting

The remedial math program will be institutionalized at Nathan B. Young Junior High School by becoming a regular part of the Compensatory Education Program. The Compensatory Education teacher will continue to use the diagnostic/prescriptive approach and the Intuitive Math Program when remediating the Compensatory Education students.

In Other Settings

The remedial math program will serve to establish a model for a demonstration center of instructional strategies and materials to assist Compensatory Education math students at Nathan B. Young and five additional seventh grade centers in the county.

CHAPTER VIII

SUMMARY AND CONCLUSION

The implementation of this practicum was successfully completed as planned. Of the seventy-five students, sixty-five students met or exceeded the first objective and seventy-two students met or exceeded the second objective. The results of an investigation for the cause of the lack of or limited success of the students who did not meet the objectives, seem to indicate that the personal problems these students encountered had a major effect on their success. Ten students had problems of school attendance, while the other three had the traumatic experience of having their parents separate and file for divorce.

All Compensatory Education Mathematics teachers developed additional needed skills in the area of teaching mathematics. As a result of the inservice sessions, Compensatory Education Mathematics teachers can now successfully integrate the Intuitive Math Program with the Individualized/Prescriptive Approach to aid in improving the basic mathematics skills of Compensatory Education students.

The basic characteristics of the program can be implemented within any mathematics program if the purpose is to

improve the basic mathematics skills. However, there are certain issues that must be addressed. They are as follows:

1. Mathematics teachers must see the need for becoming more efficient in teaching the basic mathematics skills, and must be willing to sacrifice the time for the necessary training.
2. Mathematics teachers must become comfortable in integrating the Intuitive Mathematics Program with the Individualized/Prescriptive Approach. This problem was solved through the inservice program. Teachers were first taught how to implement the Intuitive Mathematics Modules by the Intuitive Mathematics Consultants. They were next taught how to integrate these modules with the Individualized Approach. As they continued to implement the strategies, they developed confidence and became comfortable and efficient.

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BIBLIOGRAPHY

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APPENDICES

APPENDIX 1

TARGET POPULATION 1979-1980 SPRING TEST RESULTS

Table 3

Target Population 1979-1980 Spring Test Results

Subject	Raw Score	Percentile	Stanine	Grade Equivalent
1	50	23	4	4.7
2	26	3	1	2.6
3	50	23	4	4.7
4	29	4	1	2.9
5	49	22	3	4.6
6	36	9	2	3.5
7	29	4	1	2.8
8	48	20	3	4.5
9	45	17	3	4.2
10	49	22	3	4.6
11	49	22	3	4.6
12	48	21	3	4.6
13	48	20	3	4.5
14	49	22	3	4.6
15	50	23	4	4.7
16	49	22	3	4.7
17	48	21	3	4.6
18	50	23	4	4.7
19	36	9	2	3.5
20	45	17	3	4.2
21	49	22	3	4.7
22	50	23	4	4.7
23	49	22	3	4.6
24	49	22	3	4.6
25	36	9	2	3.5
26	49	22	3	4.6
27	49	22	3	4.6
28	50	23	4	4.7

Table 3 (Continued)

Subject	Raw Score	Percentile	Stanine	Grade Equivalent
29	50	23	3	4.7
30	49	22	3	4.6
31	39	11	3	3.6
32	37	9	2	3.5
33	38	10	2	3.6
34	50	23	4	4.7
35	38	10	2	3.6
36	49	21	3	4.6
37	29	4	1	2.8
38	50	23	4	4.7
39	35	8	2	3.3
40	45	17	3	4.2
41	30	4	1	2.9
42	29	4	1	2.8
43	30	4	1	2.9
44	36	9	2	3.5
45	34	7	2	3.2
46	50	23	4	4.7
47	49	22	3	4.6
48	38	10	2	3.6
49	50	23	4	4.7
50	38	10	2	3.6
51	49	20	3	4.5
52	50	23	4	4.7
53	48	20	3	4.6
54	50	23	4	4.7
55	38	10	2	3.6
56	49	22	3	4.7
57	36	9	2	3.5

Table 3 (Continued)

Subject	Raw Score	Percentile	Stanine	Grade Equivalent
58	49	23	4	4.7
59	48	21	3	4.6
60	50	23	4	4.7
61	50	23	4	4.7
62	49	23	4	4.7
63	49	23	4	4.7
64	45	17	3	4.2
65	29	4	1	2.9
66	38	10	2	3.6
67	49	22	3	4.6
68	49	23	4	4.7
69	48	21	3	4.6
70	49	22	3	4.6
71	49	20	3	4.5
72	48	21	3	4.6
73	47	19	3	4.4
74	49	23	4	4.7
75	45	17	3	4.2

APPENDIX 2

INTUITIVE MATH PROGRAM BASIC ACTIVITIES

I.1 Thingmaking

The first activity we call THINGMAKING. In order for you to think, there must be things, and you must be aware of them. Thing-making is the mental process by which you become aware of things and give them their accepted names or invent names for them. You literally make things in your mind.

You hear a loud noise. Is it thunder? A low-flying jet? An explosion? Your mind has to make something of it. You might decide it is an explosion, for example, because the building is shaking and people are shouting.

Thing-making is the primary mental ability that a child develops. When we become adults, we tend to take thing-making for granted, because we can usually tell so quickly what things are.

We can still improve our thing-making ability however. There are many new things and situations that we need to be able to identify and finer discriminations we need to become aware of: new tools, hidden defects in things we might buy, problems that are not obvious, feelings that people keep inside themselves. We need to be able to look more clearly at the world around us and see more of what is really there.

It is difficult but not impossible to develop realistic thing-making exercises for the student. Below in Figure I-1 is an example of a thing-making

I-16

exercise from Module I of the THINK program. In this exercise the student must modify the structures to illustrate the meaning of the word next to it. In so doing he will make a "thing" on paper representative of the mental "thing" he has in his head.

Study the example on the right. To solve the problems below, read the word next to each figure, then add a few lines to the figure to make a picture that will suggest the meaning of the word.

Ex:

summer



Answer:



a. broken



b. garden



c. eight



d. opposite

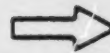


Figure I-1

The next problem requires the student to find the "things" in the drawing represented by the words above the drawing.

6. Each of these words could be used to describe something in the drawing below. Write each word by the drawing and draw an arrow from it to the part of the drawing it might describe. Use your imagination.

GLOBE FLUTE BLADE GRAVE FLAME GLOVE

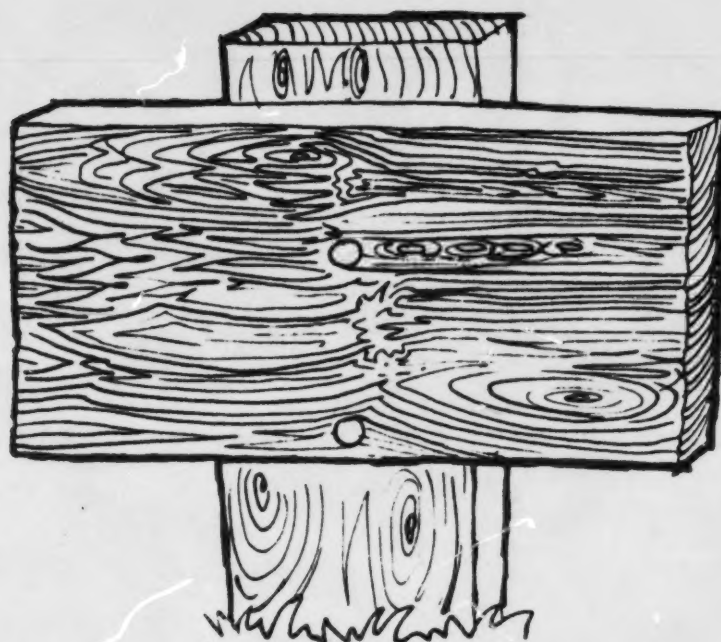


Figure 1-2

Note that in each of the preceding cases of thing-making, the student becomes actively involved in the learning process. He is not just a passive observer. He must "thing-make" or analyze behavioral thing-making and decide which is the most reasonable.

I.2 Qualification

The second activity is called QUALIFICATION. Qualification is the process of recognizing the unique characteristics in a thing -- sensory, emotional or logical aspects of the thing. Determining the qualities of a thing is what makes choice possible. Qualities can be obvious or elusive. Usually the qualities of shape and color are easily identified. But such qualities as the emotional make up, intelligence or predictability of a human being are much more difficult to distinguish. The imperfections in a diamond may not readily be seen by a layman, but the jeweler, who has refined his qualification skill as it relates to gems, has little difficulty. Our minds can actually take qualities away from their objects. The orangeness of an orange remains in our mind after the orange is eaten. It can be transferred to a table. The squareness of a box can be abstracted away from the box. The smile of the cheshire cat remained for Alice after the cat disappeared. Roundness, orangeness, squareness, smileness, happiness are qualities. We perceive them to be part of the things we make in our heads, but our minds can actually see them as separate entities which modify or change the mental things we make.

In the following examples from L&C exercises, the student is asked to choose the drawing, words, or number at the right which possesses the qualities most like those numbers or words at the left. In this way the student

must call upon his qualification skill to solve the problem. In so doing he reinforces and improves the very skill itself.

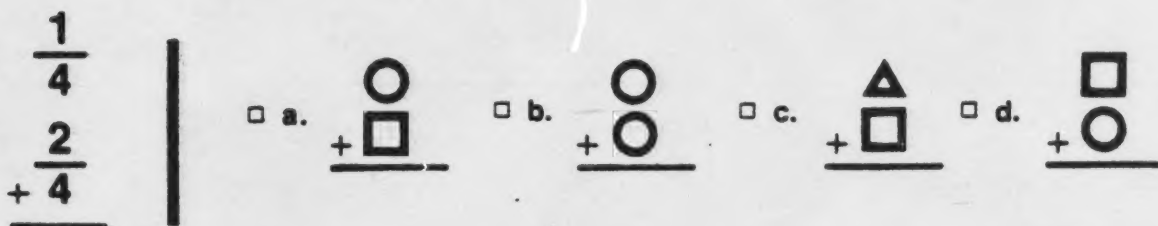


Figure I-3

Select the shape on the right side of the line that matches the shape on the left side of the line. In the blank, write the number that appears at the left of the shape you selected.

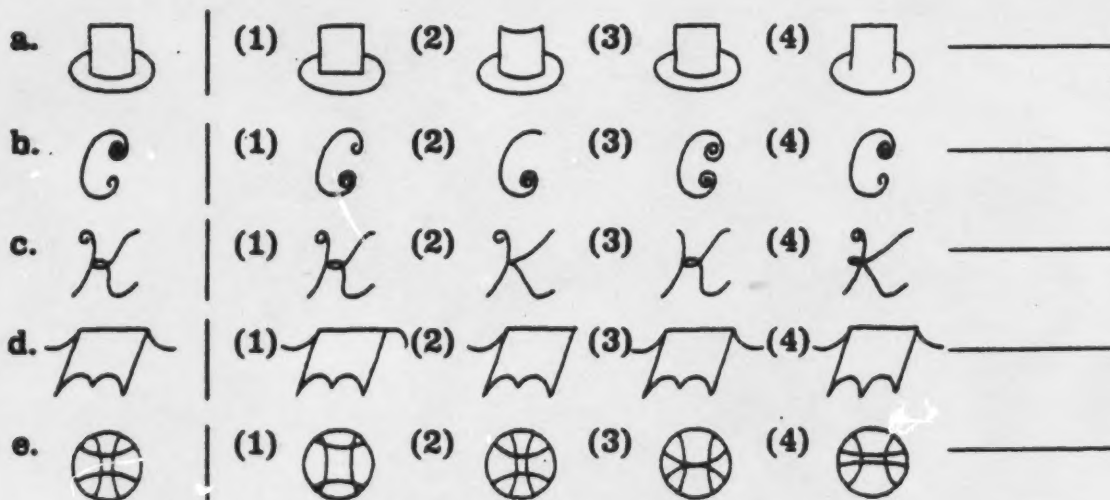


Figure I-4

DIRECTIONS: Check one of the boxes on the right that belongs with the box on the left.

a.	FICA FIT	Stub ☐ A	Major Medical ☐ B	Current Earnings ☐ C
b.	Current Gross	Social Security ☐ A	FICA ☐ B	Current Earnings Regular plus Current Earnings O/T ☐ C
c.	FICA	money for O/T ☐ A	money for working ☐ B	money for retiring disability death ☐ C

Figure 1-5

Study each word on the left. Select the word from the numbered items on the right that does not have the same "g" sound as the word on the left. Write your selection on the line. Study the example.

Ex: vigil | Gene gyp hung
(1) (2) (3)
hung

a. gave | garlic edge got
(1) (2) (3)

b. gamble | twinge brag God
(1) (2) (3)

c. fragile | huge dagger wager
(1) (2) (3)

Figure 1-6

I.3 Classification

The third activity we call CLASSIFICATION. This activity logically must follow the first two. Once we have recognized a thing and become aware of some of its qualities, we can put it into a class with other things possessing similar qualities. Classification is the process of sorting things into groups according to their qualities. The common characteristic among things we call the "sorting factor." Let's examine this more closely.

Sorting Factors

We use sorting factors extensively in our thinking. When we decide that something is the same as, or different from, something else, we have done so by sorting out its unique qualities and comparing them with the qualities of the other thing.

We could say that the shape of a book is similar to the shape of a bed if we sorted out the fact, used the sorting factor, that both have rectangular shapes. We could also determine that the shape of a book is different from the shape of a greeting card if we sorted out the fact, used the sorting factor, that the book was rectangular, and the card square.

However, we could sort out a similar quality in terms of purpose. Both are normally used to convey written information. So we could group them under a common factor -- Means of Conveying Written Information.

In order to classify we must have a sorting factor. We can classify things by abstracting, that is, by going from specific to general. For example, if you were given the things: car, horse and jungle vine, and were told to group them, you would have to find a common quality or characteristic. What characteristic do a car, horse and jungle vine have in common? They do share one, and that's use. All three can be used as a means of transportation -- a means of getting from one place to another. So under the sorting factor "Means of Transportation," you could group car, horse and jungle vine.

Another approach is to go from general to specific, to find specific things that fit into a general class. If I told you to list means of transportation on water, you would do this. I have described a quality. Now you must find things that have that quality. You might list things like boat, raft, inner tube, canoe and so forth. In both cases, you have used the process of classification.

In the first instance, you were given some things (car, horse, jungle vine) and were asked to determine what class they were in. To do this, you had to analyze their various qualities to see what, if any, qualities or characteristics they had in common, their "sorting factor." Their common characteristic "Means of Transportation" was the "sorting factor." In the second instance you were given the "sorting factor" "Means of Water Transportation," and based upon your experience, you put in that class those items you could recall which met the sorting factor.

The classification skill is one of our most essential thinking skills. Consequently, you will find an abundance of examples throughout the Logic and Comprehension sections in both THINK and Intuitive Math.

Illustrated first in Figure I-7 is an example of classification used in THINK II. Here the student is asked to classify emotions, or the words representing emotions, according to positive or negative connotation. The student must then order them within the classification according to their degree of positiveness or negativeness. The use of the thermometer helps the students see emotions, both positive and negative, in "degrees" of "hot" or "cold."

Figure I-8 is taken from THINK I at a point where the student is learning to identify long- and short-vowel words. The given words must be classified according to various double initial consonant combinations.

Figure I-9 from Intuitive Math I asks the student to classify given numbers into their hundreds, tens, or units (Sum in Ones) classes from among the givens at the bottom of the exercises.

Here is another thermometer: a "thermometer of emotions." (That's another imaginative name.)

Think: What would this kind of thermometer be, and how might it be used?

a. Write a list of as many emotions as you can think of: _____

b. You probably noticed that some emotions are positive, and some are negative. Rank these emotions from what you think are the "hottest" emotions to the "coldest" emotions of each kind.

Think: Are the "hottest" emotions number 1 or number 7?

Positive Emotions		Negative Emotions
1. _____		_____ 1.
2. _____		_____ 2.
3. _____		_____ 3.
4. _____		_____ 4.
5. _____		_____ 5.
6. _____		_____ 6.
7. _____		_____ 7.

THERMOMETER OF EMOTIONS

Figure 1-7

Write each of the following words in the correct part of the chart below. Think of the two beginning letters of the word and whether the sound of the vowel is long or short. Study the examples carefully.

✓skate	snide	snap	spat	skid
✓skip	span	smoke	stab	smile
smog	state	spike	snip	
snore	spud	stake	skim	

	sk -	sm -	sn -	sp -	st -
Ex: Long-Vowel Words	<i>skate</i>				
Ex: Short-Vowel Words	<i>skip</i>				

Figure I-8

8	5		589
9		3	930
10	9	9	

a. 9 b. 8 c. 993

Figure I-9

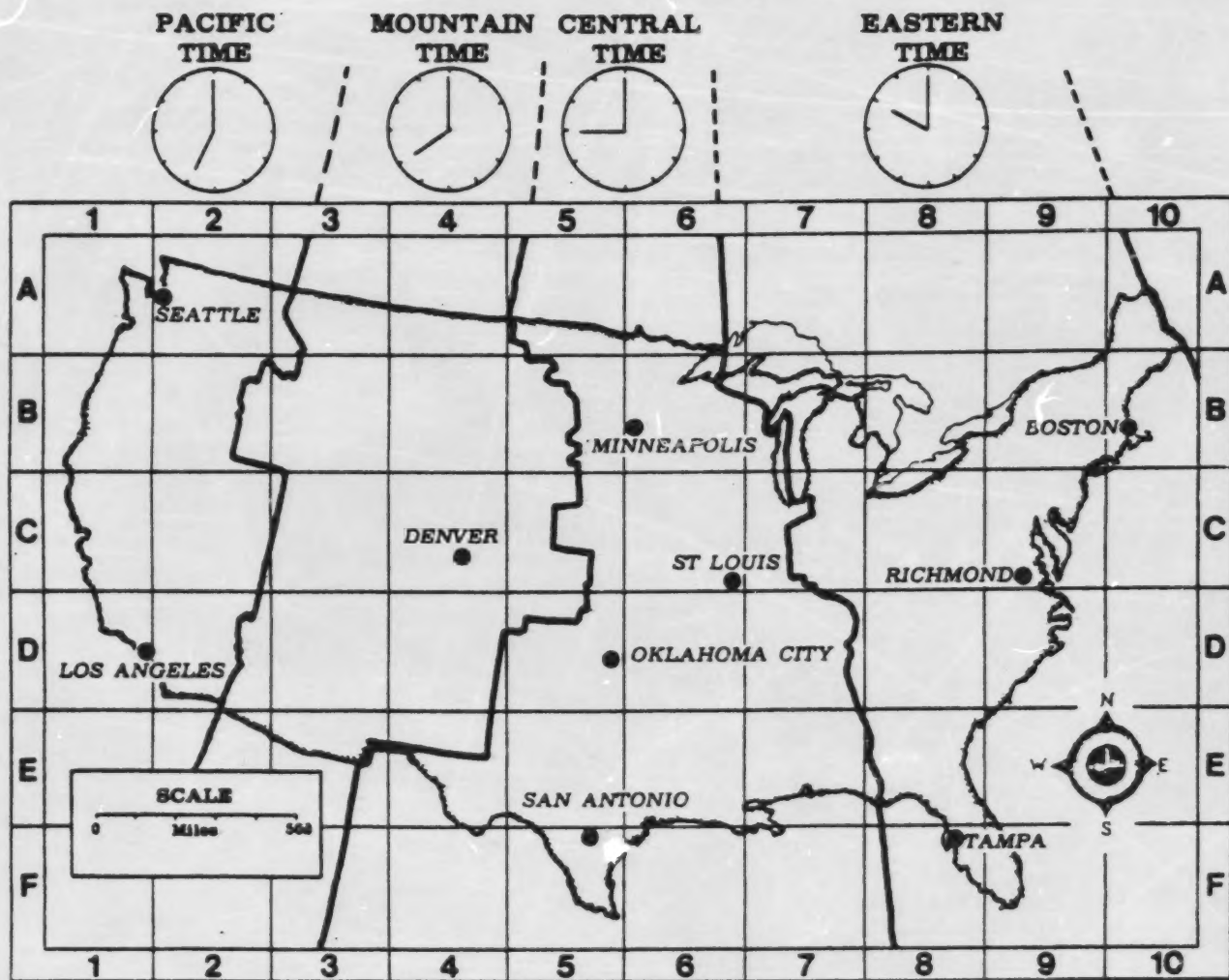
I-26

I.4 Structure Analysis

A fourth activity we call STRUCTURE ANALYSIS.

Structure Analysis is the process of dividing things into their parts and assembling parts into wholes. This is different from classification in that it considers only structurally related parts of a whole. A car, for example, might be classified as a means of transportation according to its primary use. But if you were asked to do a structure analysis, you would divide the car into its parts. You might say that the car can be divided into four broad categories -- the body, the motor, the electrical system, and the drive train. Each of these parts can be further subdivided. Remember, when you classify, you are grouping things according to some common quality. When you analyze structures, you are dividing a thing into its parts.

In the first example a map of the United States is divided into 60 squares. The student is asked to analyze the structure of this subdivided map in order to find the location of cities and then to determine the distance between cities.



a. To find Seattle, Washington, read across on Line A and down on Line 2. The closest map location of Seattle is A-2. These letters and numbers on a map are called "map keys."

b. Use the map keys to find and write down the closest map location for the following cities:

Los Angeles ____; Denver ____; Minneapolis ____; St. Louis ____;

Oklahoma City ____; San Antonio ____; Tampa ____; Richmond ____

c. Use the map keys to locate the listed cities below. For each, draw a large dot and write the name of the city on the map closest to where it belongs. (Note: These locations will not be exact.)

1) San Francisco, California: C-1

2) Salt Lake City, Utah: C-3

3) Dallas, Texas: E-5

4) New Orleans, Louisiana: E-7

5) New York City, N.Y.: C-9

6) Chicago, Illinois: C-7

7) Savannah, Georgia: E-8

8) Memphis, Tennessee: D-7

9) Atlanta, Georgia: D-8

10) Helena, Montana: B-3

Figure I-10

The second example is used to study syllabic structures in order to create words.

Study the example on the first line to see how a word can be created from syllables. Then create a word in each line by circling the proper syllables. Write the word you have created and tell how many syllables it has.

Ex:	fa	an	ght	vor	ta	ite	<i>favorite</i>	3
a.	bat	ser	es	ter	ret	as		
b.	sum	er	ser	at	mer	ta		
c.	fig	der	red	ope	ure	ness		
d.	wel	ness	come	ful	ter	at		
e.	Sat	ing	ope	ur	day	ret		
f.	ar	ful	ti	ing	ser	cle		
g.	Sa	ing	ope	lem	er	ret		

Figure I-11

I.5 Operation Analysis

A fifth activity we call OPERATION ANALYSIS. This is the activity of dividing an event into its phases or stages and ordering events into operations. One of our mental abilities is that of being able to "see" events or operations. Many events appear obvious: a day, a week, a football game, a party, a dinner. Others are less obvious, and often require the help of new or specialized words to capture them for us. Such events as an "era," "industrial revolution," or "honeymoon,"

can be perceived by the mind, but sometimes require the help of specialists or new or specialized words. Once our minds have captured or "seen" an event, we are capable of breaking it down into its component stages and ordering it chronologically, as it occurred. This is Operation Analysis. It can be done on past events, present events or future events. The word "plan," when used as a verb, usually means an analysis of a future event, done so that the event can come about or be controlled.

Remember, we said that a car could be classified as a means of transportation. We said that you could analyze the structure of a car by dividing it into parts. But if you were learning how to drive a car, you could be asked to analyze the sequence of events in getting the car moving -- from the time you got into the car until it was in motion. You might say, first, put key in ignition; second, make sure shift lever is in "park" or "neutral;" third, press accelerator; fourth, turn key and hold until motor starts; fifth, shift into drive; and sixth, press accelerator slowly until car moves. In doing this, you have performed an operation analysis; you have analyzed the sequence of events.

Let's compare the difference between structure analysis and operation analysis. Let's look again at the car, this time at one of the cylinders in the engine. First, let's do a "structure analysis" with the aid of the cutaway cylinder in Illustration I-4. The cutaway drawing has

I-30

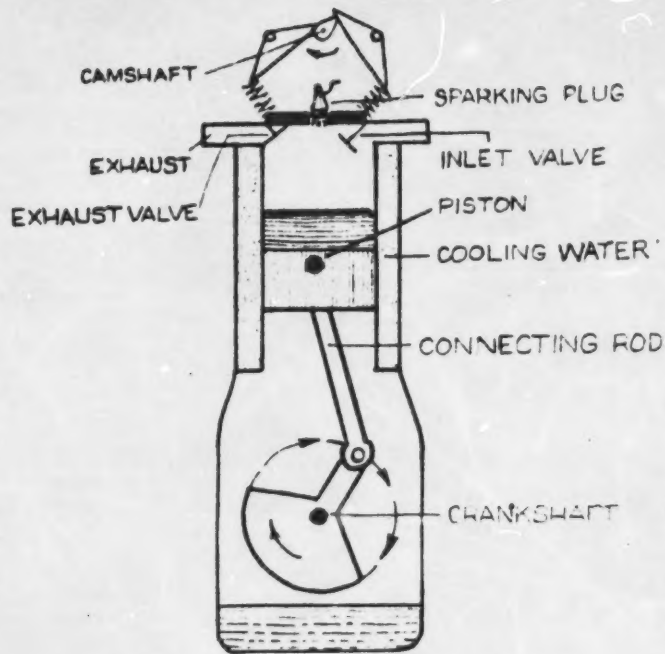


Illustration I-4

But our understanding is not yet complete until we see an operation analysis of "how" -- in what sequence -- it works. For us to comprehend this we need to see the "event" of two cycles. A four-stroke engine goes through a process of two rotations: two down strokes of the piston and two up strokes. We can illustrate this with the aid of four separate drawings, some arrows and a little imagination.

each important part of the cylinder structure labeled. To understand the internal combustion engine we first must know what the structure is, and what its parts are. The drawing is a structure analysis, each part diagrammed and named. Study of the drawing will give us an understanding of what a cylinder is.

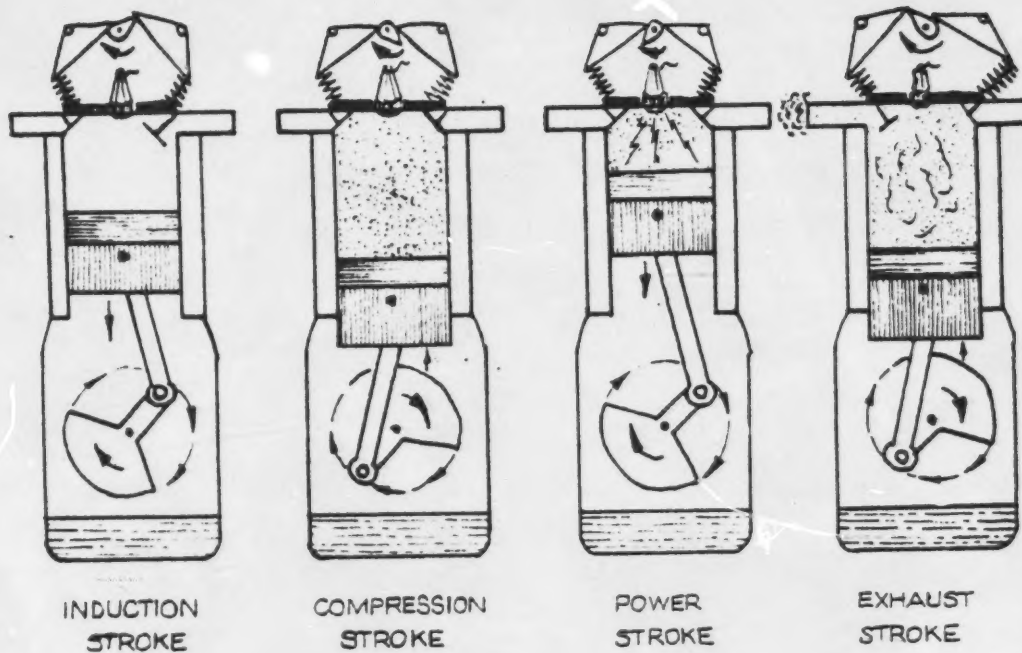


Illustration I-5

Now our minds can capture an event and "know" what is happening. The actual process happens far too quickly for our eyes, even if we could see an engine cutaway, to send meaningful data to our brain. The use of names for each of the four stages within the event further helps us know and comprehend what is happening.

Before we can comprehend how the cylinder is able to do its job within an engine and how that job results in propulsion for our car, we would have to enlarge our "structure" and examine several more parts. Further, we would have to enlarge our "event" beyond two cycles of a cylinder to a much longer event which starts when we turn the key to when we pull away from the curb.

Figures I-12 and I-13 are taken from the Intuitive Math program. In math, Operation Analysis is always given in the form of sequencing problems. A list of figures is given. Each succeeding figure differs from the previous one because an "unseen" arithmetic function (or functions) has been applied to it. The student must identify the function and then "prove" he knows it by supplying the proper item in the missing space.

Directions: Study the arrangement of the numbers in the problems below. In each case, a part is missing from the arrangement. Write in the missing part.



20 , 19 , 17 , 14 , _____ , 5

Figure I-12

Directions: Study the arrangement of the numbers in the problems below. in each case a part is missing from the arrangement. Write in the missing part.

$$\frac{3}{9}, \frac{2}{6}, \frac{1}{3}, \frac{3}{9}, \frac{2}{6}, \frac{1}{3}, \underline{\hspace{1cm}}$$

$$\frac{1}{3}, \frac{2}{6}, \frac{3}{9}, \frac{4}{12}, \underline{\hspace{1cm}}, \frac{6}{18}, \frac{7}{21}, \frac{8}{24}.$$

$$\frac{1}{9} \div \frac{1}{8}, \frac{1}{7} \div \frac{1}{6}, \underline{\hspace{1cm}}, \frac{1}{3} \div \frac{1}{2}.$$

$$\frac{2}{3}, \frac{2}{4}, \frac{2}{5}, \frac{4}{6}, \frac{4}{8}, \frac{4}{10}, \frac{2}{3}, \frac{2}{4}, \underline{\hspace{1cm}}.$$

$$\frac{1}{2} \div \frac{1}{12}, \frac{1}{2} \times \frac{12}{1}, \frac{1}{4} \div \frac{1}{24}, \underline{\hspace{1cm}}.$$

Figure I-13

Figure I-14 from the THINK program calls upon the student with the help of his teacher to apply what he has just learned in the lesson atomic energy and use a pictorial flow chart to discuss in step-by-step fashion how electricity is produced from uranium and finally delivered to its point of use.

Work with your Moderator to analyze the process below for getting electricity from uranium.

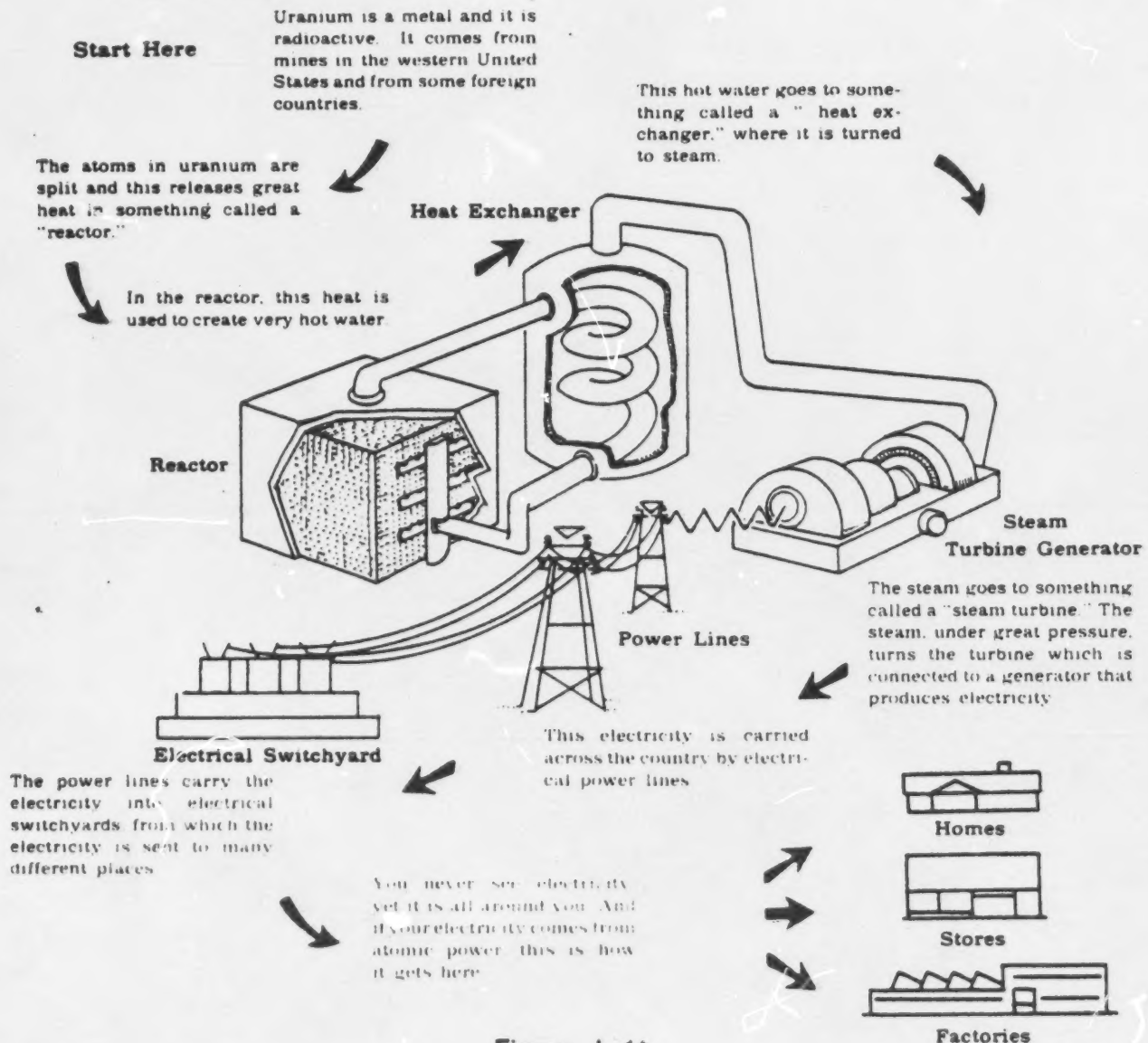


Figure I-14

I-35

In Figure I-15 from ISI's consumer education and job skills program, an analogy is drawn from money budgeting to time budgeting where the clock face is substituted for the "pie" of total income. As the student carves out his daily activities on the 12-hour clock, he automatically ends up with a "time budget." His Operation Analysis of his activities results in a Structure Analysis of his day.

DIRECTIONS: Time can be budgeted, or planned, as well as money. Make a budget of your day from 6 A.M. to 6 P.M. by dividing up the clock below into sections of time for each of the following activities: breakfast, lunch, dinner, transportation to and from work, relaxing. See example:

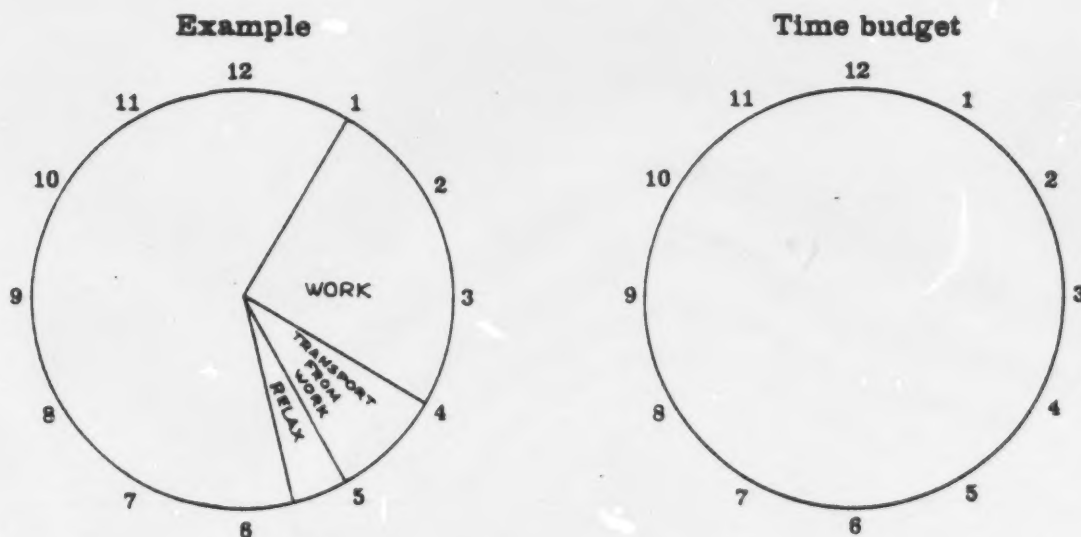


Figure I-15

1.6 Seeing Analogies

"Necessity is the mother of inventions."

"You can count on that fanatic to rustle a few leaves."

"Absolute freedom of the press. . . is the foundation stone of liberty."

"He weaves a fine tale."

"A successful election campaign is the result of a well-thought out battle plan."

Each of the above sentences is an analogy, some of the parts of which are implied by connotative meaning of certain key words. The metaphor and the simile in language almost always bring us new meaning through use of a device called analogy.

Technically, the analogy is a four part statement that states that two things are related to each other in at least one way that two other things are related to each other. To state it symbolically:

A relates to B as

C relates to D

or

$$\frac{A}{B} \text{ as } \frac{C}{D}$$

The first epigram above, "Necessity is the mother of inventions," helps us see that the relationship of necessity and invention is similar to the relationship of a mother and her child. One brings the other forth.

necessity as mother
invention child

The relationship that each has in common is "causes an end result." This common relationship is called the "relating factor." Let's examine more closely the use of relating factors.

Relating Factors

We use the term relating factor frequently in referring to the relationship that exists between two pairs of things in an analogy. A simple analogy looks like this:

book as record
writer vocalist

A book is to a writer as a record is to a vocalist.

The key in determining the relating factor is the phrase "is to." A book may relate to a writer in many ways, and a record may relate to a vocalist in many ways. The key is to find a relating factor between the two relationships, some similarity that both relationships share. In the above example, we are talking about a relationship of primary purpose or use. The purpose of a book is to convey the writer's creation as the purpose of a record is to convey the vocalist's creation. The phrase "conveys the creation of" then is the most acceptable relating factor.

Seeing Analogies plays an important role in the process of learning. When we are confronted with a new or unfamiliar situation, our minds go to work trying to identify something in the situation with which we might have had experience. Even though the components of the situation may be unfamiliar,

if we can see relationships between those parts with which we are familiar, we can begin to comprehend the whole much more rapidly.

Let's return to our epigram for a moment. When we look around today at the thousands of things and processes created by man, it's conceivable for us to wonder how they ever came about. Are they all the random tinkering of men in their laboratories? Some, of course, are. But when someone says, "Necessity is the mother of inventions," we quickly realize that most inventions are the result of some apparent and immediate necessity. We already know that children are the result of motherhood (which is the result of something else, which doesn't concern us here), and now we can see "invention" in a new light.

The ability to see analogous relationships has long been considered to be a sign of intelligence. But little, if anything, has been done to help us improve our ability in this area.

The ISI programs place heavy reliance on the use of analogy. It not only aids the student in comprehending the content to which it is related, but also helps the student to think analogously. As John Dewey said, "We learn what we do."

Let's look at some of the ways analogy is used in Third Generation learning. The use of analogies in the lower modules of ISI programs is at a low level of abstraction. Often the student is asked merely to identify vowel sound analogies of printed words:

Choose from the numbered items and complete the analogies. Write your answers in the blanks. Think of the sounds of the words. Study the example.

a. $\frac{\text{base}}{\text{rave}}$ as $\frac{\text{rat}}{(\quad)}$

1) rate 2) rut 3) can

c. $\frac{\text{cot}}{\text{cat}}$ as $\frac{(\quad)}{\text{pat}}$

1) dole 2) pot 3) lot

e. $\frac{\text{lid}}{\text{lad}}$ as $\frac{\text{hid}}{(\quad)}$

1) hide 2) lot 3) had

g. $\frac{\text{hole}}{(\quad)}$ as $\frac{(\quad)}{(\quad)}$

1) hive 2) dole 3) dive

Figure I-16

As the student progresses through THINK, the level of language usage changes. Here from the latter part of THINK I are analogies which require the student to think about the meaning of words.

() as fat dull thin 1) slim 2) shiny 3) skinny	fad as () craze way 1) method 2) phase 3) hay
rich as shadow () light 1) wish 2) poor 3) enjoy	chime as () sound sight 1) chin 2) push 3) light

Figure I-17

By the time the student is at the second module, he is ready for more complex analogies, which call upon him to think of contextual or connotative meanings. In addition he must now supply the "relating factor" in writing. He has been encouraged to do this orally throughout Module I.

Complete and read this analogy, using one of the following words: citizen; honor; campaign; plot.

battle plan as ()

battle election

Relating factor? _____

(Line 20)

Read the following analogy:

a fanatic as storm

idea leaf

Relating factor? _____

Figure I-18

APPENDIX 3

INSERVICE EVALUATION FORM PARTICIPANT RATING SCALE

Hillsborough County Public Schools
Inservice Education Program Participant Rating Scale

INSTRUCTIONS FOR RATING CRITERIA

Criteria for evaluating this inservice activity are listed at the right. Please complete the evaluation by circling the letter reflecting your judgment of each item according to the scale shown. It is important that you respond to all items. Do not overlook the (F) option where it is appropriate.

- A. I strongly agree
- B. I agree
- C. I agree, with some reservations
- D. I disagree
- E. I strongly disagree
- F. This item does not apply to this workshop

Date: _____

Subject: _____

Grade: _____

PROCEDURAL OUTCOMES	1.	A B C D E F	A clear statement of the purpose of the workshop was made.
	2.	A B C D E F	Objectives were clearly stated at the outset
	3.	A B C D E F	Activities were in logical sequence
	4.	A B C D E F	Grouping techniques utilized were effective
	5.	A B C D E F	Appropriate grouping was done.
PROCESS OUTCOMES	6.	A B C D E F	Content level was appropriate for me.
	7.	A B C D E F	Appropriate opportunity was given for sharing ideas and/or questions.
	8.	A B C D E F	Leaders of this activity were well prepared. (List names and comments on back, if you desire.)
	9.	A B C D E F	Directors responded readily to group needs.
	10.	A B C D E F	Adequate materials were supplied.

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SUMMATIVE
OUTCOMES

- | | | | | | | | |
|-----|---|---|---|---|---|---|---|
| 11. | A | B | C | D | E | F | Program content related directly to stated objectives. |
| 12. | A | B | C | D | E | F | The program was keyed to my important concerns. |
| 13. | A | B | C | D | E | F | I will be able to apply what I have learned to job re-
lated problems. |

PLEASE WRITE COMMENTS AND SUGGESTIONS ON THE BACK